

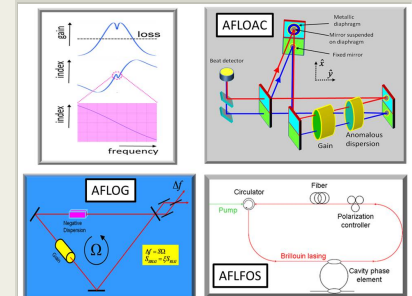
Fast Light Enhanced Active and Passive Gyroscopes, Accelerometers and Fiber- Optic Sensors, Phase I

Completed Technology Project (2015 - 2015)



Project Introduction

The fast-light effect in a cavity, produced by anomalous dispersion, has emerged as an important mechanism for enhancing the sensitivity of many devices. There are two modes of operation of such a cavity. In the active mode, the system is a superluminal ring laser (SRL) that experiences an anomalous dispersion caused by the gain medium. In the passive mode, the system is a white light cavity (WLC) that experiences an anomalous dispersion caused by an intra-cavity medium or via coupling to another cavity or another mode in the same cavity. We will investigate the development several closely related technologies based on the fast light effect: gyroscopes, accelerometers and general purpose fiber-optic sensors. For each technology, we will primarily pursue the active approach. The gyroscope will be based on using a pair of spatially overlapping SRLs realized via Raman gains, with Raman depletion used for anomalous dispersion. The accelerometer will be realized by using a similar system, but with two lasers that are spatially shifted with respect to each other. The fiber-optic sensor will be based on using a pair of Brillouin gain based SRLs, where the anomalous dispersion is produced via coupling to a cavity. In addition, for each device, we will investigate theoretically some passive techniques in order to determine relative advantages and tradeoffs between the two approaches. Specifically, for the gyroscope and the accelerometer, we will investigate the use of couple cavity based WLCs; for the fiber-optic sensor, we will investigate the use of a WLC realized by dual-peaked Brillouin gain. The particular mode of operation to be pursued for developing a practical version of each of these devices under Phase II will be established in accordance with the findings of the Phase I effort, and potential feedback and guidance received from the NASA program manager. Northwestern University, with Prof. Shahriar as the PI, will be a subcontractor.



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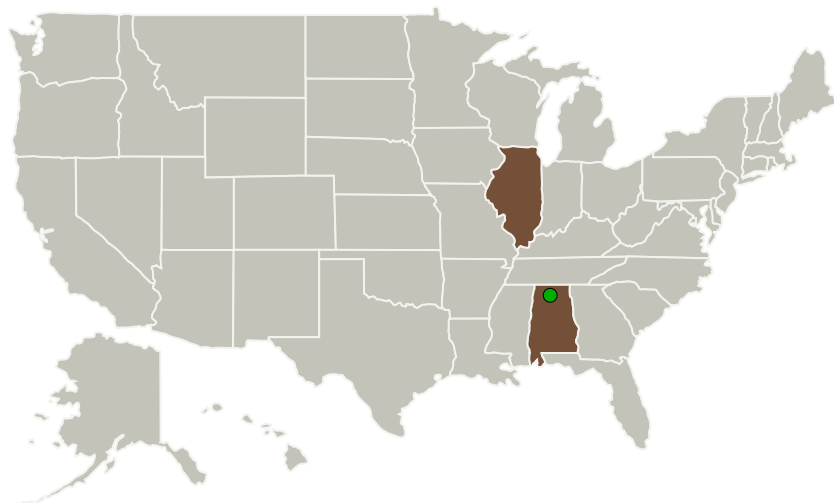
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Digital Optics Technologies, Inc.	Lead Organization	Industry	Rolling Meadows, Illinois
● Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations

Alabama	Illinois
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Project Transitions

▶ **June 2015:** Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Digital Optics Technologies, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

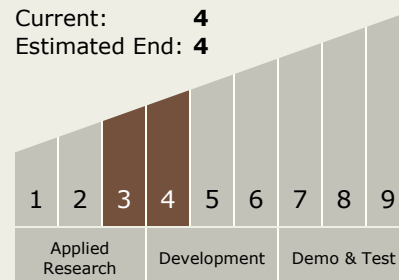
Carlos Torrez

Principal Investigator:

Nicholas J Condon

Technology Maturity (TRL)

Start: **3**
 Current: **4**
 Estimated End: **4**



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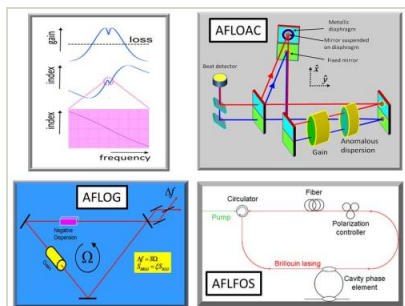
✓ **December 2015:** Closed out

Closeout Summary: Fast Light Enhanced Active and Passive Gyroscopes, Accelerometers and Fiber- Optic Sensors, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image(<https://techport.nasa.gov/file/139003>)

Images



Briefing Chart Image

Fast Light Enhanced Active and Passive Gyroscopes, Accelerometers and Fiber- Optic Sensors, Phase I

(<https://techport.nasa.gov/image/132367>)

Technology Areas

Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
 - └ TX17.2 Navigation Technologies
 - └ TX17.2.3 Navigation Sensors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System